

DF6113 LED Backlight Driver

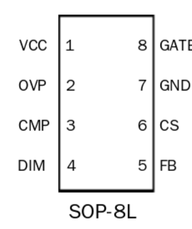
General Description

The DF6113 is a simple LED controller IC that boosts a 5-24V DC input to produce a precision, current-regulated output. The DF6113 is especially suited to LCD backlight applications.

Linear dimming modes allow stable adjustment of total output current from 10%~100%. The IC includes output short-circuit and over-voltage protection.

Features

- DC input voltage range 5-24V
- Single configurable current-regulated output
- 10%~100% output current adjustment
- Positive or inverted analog dimming control
- Built-in power management and soft-start
- Output short-circuit and over-voltage protection



Applications

- Portable display device
- Desktop LED flat panel display
- LCD TV, monitor

Ordering Information

Part number	Package	Operating temp	Other
DF6113	SOP8	-20℃～+85℃	RoHS

Absolute Maximum Ratings

(Input voltage Vin=20V)

Junction temperature (Tj)	150℃
Power dissipation (Pd)	1.0W
Switching frequency	600KHz
Storage temperature	-55℃～+150℃

Recommended Operating Conditions

Input voltage (Vin)	5~24V
Switching voltage (ENA)	0~5V
Dimming voltage (DIM)	0~5V
Operating frequency	200~500kHz
Operating temperature	-20℃～+85℃

Functional Diagram

CMP
4.5V
VIN
UVP Comp.
Internal Reference
Load Current Measurement
CS
OVP Comp.
OVP
1.0V
LOGIC CONTROL
Shutdown Comparator
Driver
GATE
Error Amp.
DIM
Ext. Current Control
Hi-Freq. Oscillator
FB
GND

Pin Functions

(DF6113)

PIN	Description
1 VCC	DC power input
2 OVP	Boost over-voltage detection
3 CMP	Boost soft-start control
4 DIM	<1.0V chip disabled, 1.1V-3.2V dim control
5 FB	LED ouput current sense
6 CS	Inductor current sense
7 GND	Ground
8 GATE	Boost MOSFET gate drive



Electrical Parameters

Vin=12.0V, Ta=25°C unless otherwise noted

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
General Characteristics						
Quiescent current	I_{OFF}	DIM=0V		1.0	10.0	μA
	I_{ON}	DIM=3V	6	7	9	mA
DIM input	V_{DIM}	Chip off	0		0.9	V
		Chip on	1.0		5.0	
		DIM off (LED current <10%)	0		1.0	
		DIM on (LED current 10%~100%)	1.1		3.2	V
Boost Converter						
Startup / Dropout	V_{LH}	DIM=3V	4.5			V
	V_{LL}	Under-voltage protection limit			4.0	
Maximum input voltage	V_{INMAX}	DIM=3V	24			
CMP pull-up current	I_{CMP}	C_{CMP}=100nf		10		μA
MOS gate current	I_{GATE}	Peak current at time = 0	500			mA
CS terminal max voltage	V_{CSMAX}	ENA=3V, DIM=3V, R_{DIM}=20K CMP at steady state	600			mV
Switch Freq.	f_{OSC}	ENA=3V, DIM=3V, R_{DIM}=20K external inductor=47uH	300	350	400	KHz
Max/Min duty cycle	D_{MAX}		88	90	92	%
	D_{MIN}		8	10	12	
OVP detect voltage	V_{OVP}	external output capacitor = 22uF	1.00	1.05	1.10	V

Application Guidelines

DIM Control

A series resistor is recommended to prevent power supply noise from affecting the DIM input.
Chip operation is disabled when DIM < 0.9V
Analog brightness control of 10% ~ 100% when DIM 1.1V ~ 3.2V
Output current is approximately 100% when DIM > 3.2V

Current Adjustment

When the DIM pin is held above 3.2V, the boost controller provides 100% current output.
100% current is calculated as follows:

$$I_{OUT} = I_{MAX} = 420mV/R_{OUT}$$

For example, when using a current sense resistance of R_{OUT} = 3Ω, the lamp current is:

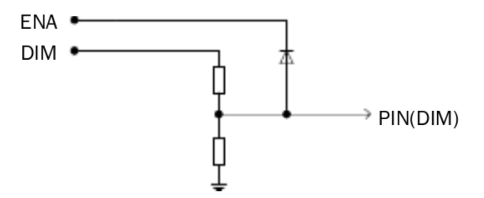
$$I_{OUT} = 420mV / 3\Omega = 140mA$$

Dimming Control Modes

Single control signal

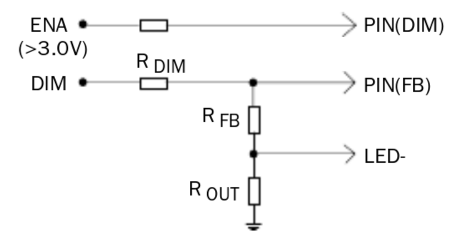
DIM R_{DIM} PIN(DIM)

ENA+DIM positive analog dimming (high voltage brightest)



Normal operation when ENA held high or left floating
Chip disabled when ENA=GND

ENA+DIM inverted analog dimming (low voltage brightest)



ENA voltage > 3.0V; output current increases as DIM voltage decreases

Output Short-Circuit Protection

The FB pin used with resistor RFB = 2k prevents high voltage breakdown in the event of a shorted output by disabling switching operation to protect the switching MOSFET.

DF6113 Boost Mechanism

The external inductor provides energy storage to boost the input voltage; the output capacitor is secondary energy storage to reduce output current ripple. The Schottky diode and MOSFET also greatly affect total system efficiency. Recommended DC/DC step-up ratio is less than 1:5.

Boost Component Selection

The external inductor is typically 47 ~ 100uH, corresponding to a switching frequency of 300kHz. The value of R_{MOS} in series with the MOSFET determines the maximum output power; the reference designs below specify R_{MOS}=0.3Ω and an output power of 10W.

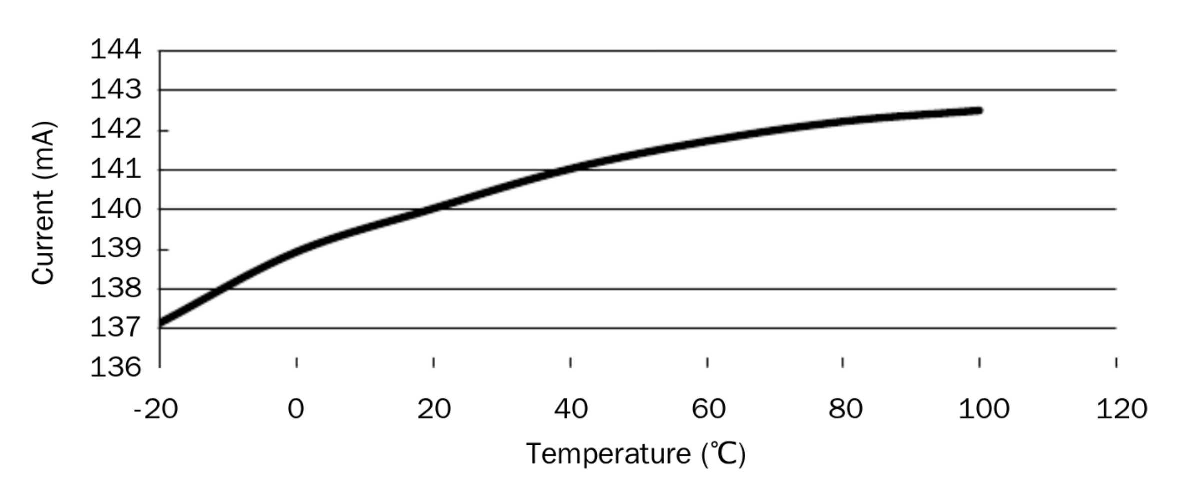
Over-voltage Protection

When the voltage at the OVP pin (the output voltage after division between R2 and R3) exceeds 1.05V, the converter halts and disables the MOSFET to prevent over-voltage breakdown.
The recommended OVP threshold is 10% above the maximum LED design voltage.

Supply Isolation

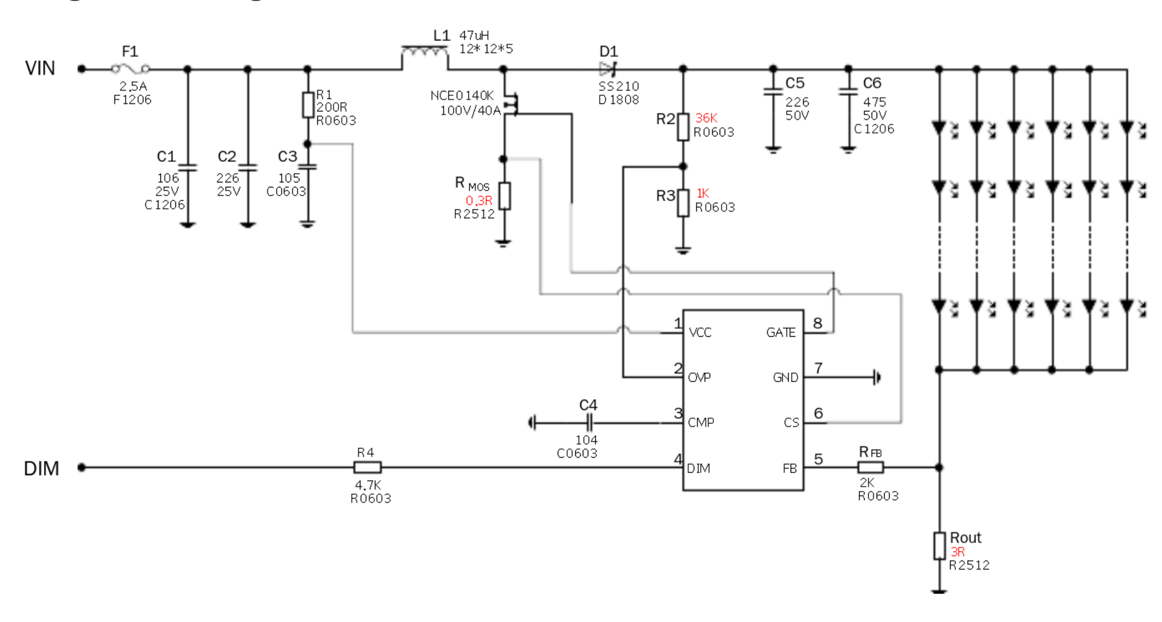
To ensure stability under high power operation, a 10 ~ 200 Ω resistor in series with the VCC power input pin is recommended to improve supply isolation.

Thermal Stability Curve

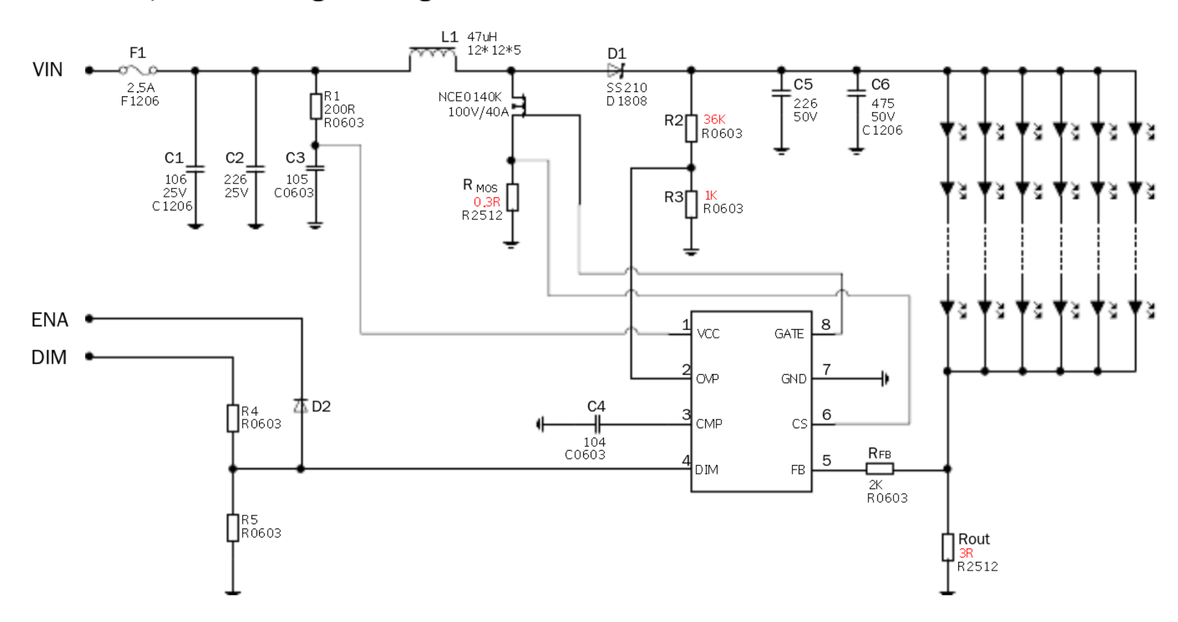


Typical Applications

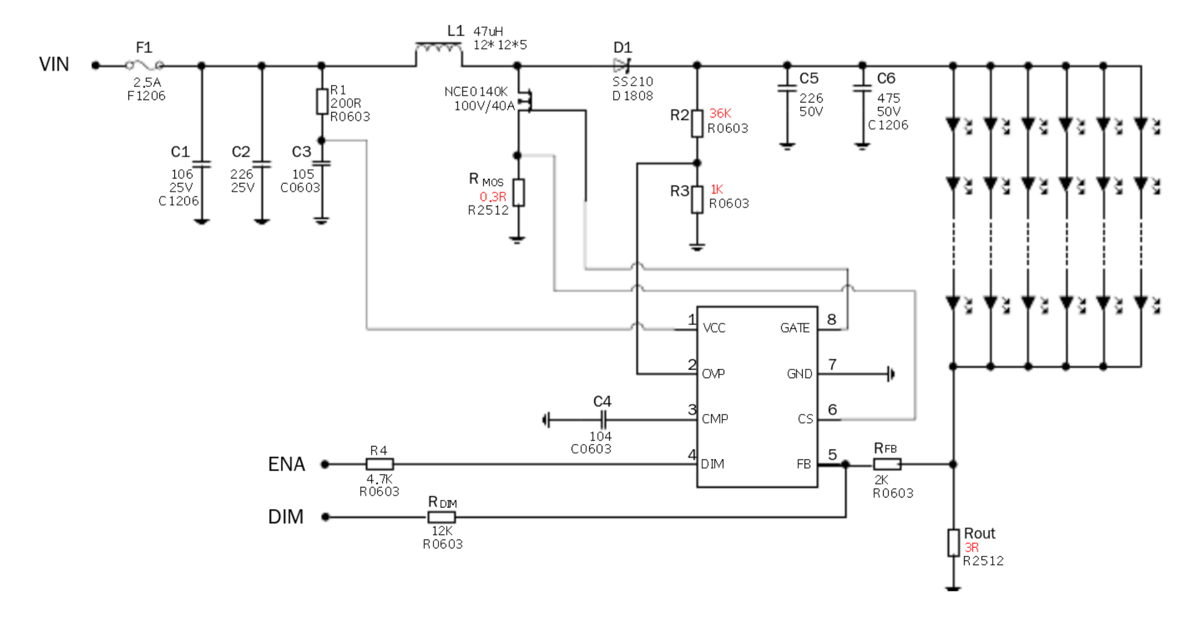
Single control signal



ENA+DIM positive analog dimming

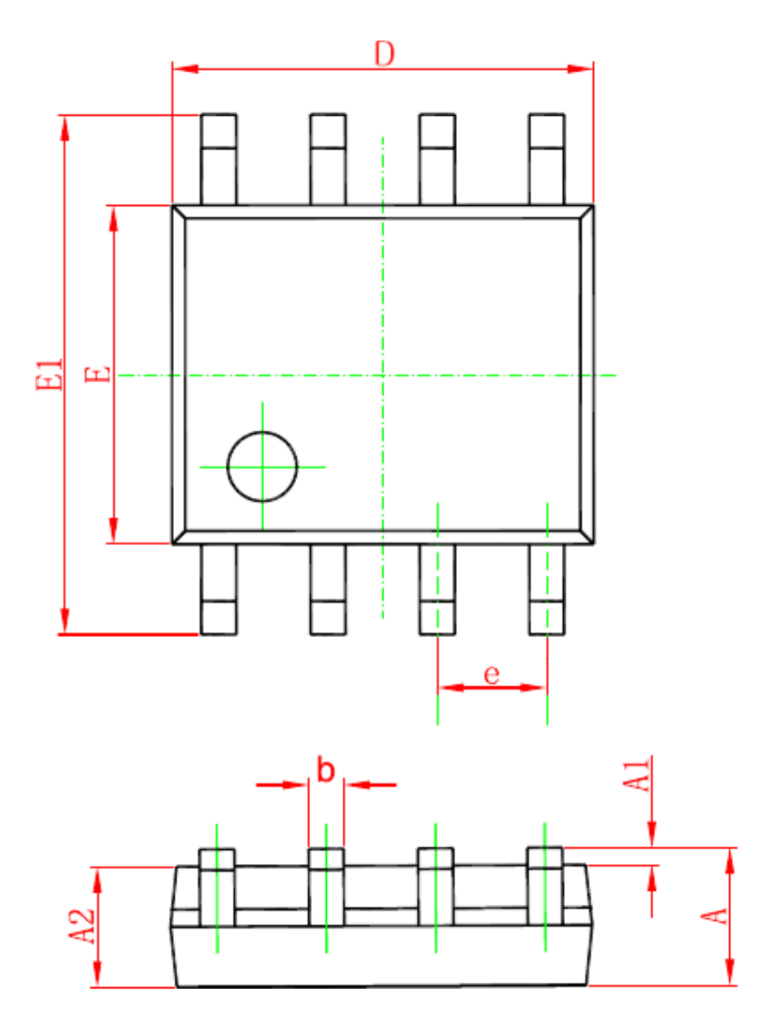


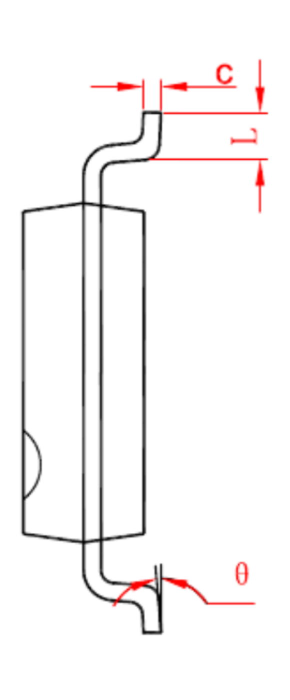
ENA+DIM inverted analog dimming



Package Information

SOP8





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°